Introduction to computer engineering
Laboratory 3

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1 Chapter 6

Submit your codes and report in blackboard in the same way as the previous laboratory.

1.1 Text

Write a program to print the lyrics of the song "Old MacDonald". Your program should print the lyrics for five different animals, similar to the example below (**use function to simplify the code**):

   Old MacDonald had a farm, Ee-igh, Ee-igh,Oh!
   And on that farm he had a cow, Ei-igh,Ee-igh, Oh!
   With a moo, moo, here and a moo, moo there.
   Here a moo, there a moo, everywhere a moo, moo.
   Old MacDonald had a farm, Ee-igh, Ee-igh,Oh!

1.2 sums

Write definitions for the following two functions:

- `sumN(n)` returns the sum of the first n natural numbers.

- `sumNCubes(n)` returns the sum of the cubes of the first n natural numbers.

Then use these functions in a program that prompts a user for an n and prints out the sum of the first n natural numbers and the sum of the cubes of the first n natural numbers.

1.3 Range

Write a Python function to check whether a number falls in a given range. The function should take as input 3 parameters(the number and two numbers to define the range)

1.4 Maximum

Write a Python function to find the Max of three numbers.

1.5 Bisection method

Let be f a equation: $f(x) = ax^3 + bx^2 + cx + d$. We want to find x such as $f(x) = 0$. Write a program which do the following thing:

1. Ask the user for a, b, c and d.

2. Write a function which take as input a number x and return $f(x)$.

3. Write a function which identifies a value l such as $f(l) < 0$ (*hint: you can use the sign of a*)

4. Write a function which identifies a value r such as $f(l) > 0$

5. Use the bisection method to have an approximate solution of $f(x) = 0$. (Stop when $|f(x_{approximate})| \leq 0.001$)

The bisection method is an iterative method to approximate a solution for a function f continuous on [a,b]. If f(a) and f(b) have different signs, then there is at least one value x such as $f(x) = 0$. Let be $c = \frac{a+b}{2}$. If $f(c)$ is small enough c is an approximate solution. Otherwise, depending the sign of $f(c)$, we iterate on the interval [a,c] or [c,b].

2 Optional exercises

2.1 Multiplication of a list

Write a Python function to multiply all the numbers in a list. (see documentation about the list datatype). We assume that all members of the list are numbers.

2.2 Function with variable number of arguments

NOTE: For this exercise you must first read about function having a variable number of arguments. One of the goal of this exercise is to search inside documentations. Write a function taking at least 2 arguments (we assume they are numerical values) and does the following:

1. print the number of elements passed to the function ($f(a, b, c)$ shoud print 3).

2. return the maximum among all elements except the first one

3. return the average value of all elements except the first one

4. return the median of all elements except the first one (difficult)

5. display if the first argument of the function is also present in the set of other arguments (difficult)